PCT/EP 00/06016

INVESTOR IN PEOPLE

10/030223

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 10 AUG 2000

WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed A M Brewer.

Dated 10 May 2000

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

THE PATENT OFFICE
K
- 8 JUL 1999
RECEIVED BY POST

08JUL99 E460332-2 003072
P01/7700 0.00 - 9915883.4

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference

SJW/7096

2. Patent application number
(The Patent Office will fill in this part)

9915883.4 -8 JUL 1999

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Cerestar Holding B.V.
Nijverheidsstraat 1
PO Box 9
4551 LA Sas van Gent
Holland

Patents ADP number *(if you know it)*

4068775002

If the applicant is a corporate body, give the country/state of its incorporation

Holland

4. Title of the invention

"Preparation of Sugar-Free Hard Candy"

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Stevens Hewlett & Perkins
1 St. Augustine's Place
Bristol BS1 4UD
United Kingdom

Patents ADP number *(if you know it)*

1545002 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	-
Description	14
Claim(s)	2
Abstract	1
Drawing(s)	3 + 3

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature Stevens Hewlett & Perkins Date 07/07/99

STEVENS HEWLETT & PERKINS

12. Name and daytime telephone number of person to contact in the United Kingdom — S J WILKINSON — 0117 922 600[redacted]

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

Preparation of Sugar-free Hard candy

Technical field

The present invention relates to mixtures consisting of maltitol syrup and isomalt powder or isomalt syrup. The present invention also discloses a process for producing sugar-free hard candies. In addition a new type of sugar-free hard candies is disclosed. The candies are non-hygroscopic, non-cariogenic and show excellent mass viscosity.

Background of the invention

Recent developments in hard candy manufacture have been the replacement of part or all of the sugar by a sugar alcohol (polyol) in the interest of providing a product having a reduced calorie content and a lower tendency to cause tooth decay. Among the polyols, which have been proposed for the manufacture of hard candy, are isomalt, maltitol, xylitol, erythritol and others.

EP 0 533 334 describes a process for the production of hard candy characterised in that the maltitol content of the sugar alcohol mixture is more than 77% but less than 86% by weight based on dry substance. When the mixture contains 77% or less maltitol the resultant candies become increasingly hygroscopic and sticky, while when the mixture contains 86% and higher maltitol the candies rapidly become opaque as a result of the maltitol crystallisation.

EP 0 611 527 describes a controlled propagation of crystallisation of maltitol in hard candies by applying molecules of molecular weight greater than 1,300 Dalton, preferably greater than 2,000 Dalton and more preferably greater than 3,000 Dalton. Preferably syrups comprising more than 78% maltitol are applied, since syrups comprising less than 60% maltitol give unsatisfactory results in respect to hygroscopicity, cariogenicity and unsuitable application.

US 4,971,798 describes a hydrogenated isomaltulose based hard confection which contains, in addition to the hydrogenated isomaltulose, a medicinal active ingredient. Such a formulation has been found to dissolve more slowly than similar formulations based on sugar rendering them suitable for dispensing the active ingredient over an extended period time.

Furthermore hard candies based on hydrogenated isomaltulose are non-hygroscopic but the mass viscosity of hard candies based on hydrogenated isomaltulose is low.

WO 97/30598 describes a sweetener consisting of especially 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS) and 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM), and the use of this sweetener in hard and soft caramels, especially pharmaceutically active caramels. The presence of 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS) results in candies with improved solubility, higher sweetness and lower ability to crystallise, but hard candies based on these hydrogenated isomerised saccharose syrups have even lower mass viscosity than the hard candies based on hydrogenated isomaltulose.

A process for producing hard candies comprises preparation of syrups, cooking at elevated temperature and shaping including a cooling phase. The mass viscosity of the hot (temperature > 90°C) syrups is determining the workability and the processing time of the cooling phase. Applying low viscous syrups results during the cooling phase of the shaping of hard candies in a very liquid mass, which needs a considerably long processing time before the mass can be shaped in moulds.

Accordingly there is a need for highly viscous syrups which are non-hygroscopic and which can be used for the preparation of i.e. sugar-free non-hygroscopic and non-sticky hard candies. Applying high viscous syrups shortens the processing time of the cooling phase considerably and it results in an economical advantageous process.

Summary of the invention

The present invention discloses the preparation of highly viscous syrups at dry substance between 60% to 80%, preferably of about 70%, consisting of a mixture of maltitol syrup and isomalt. Isomalt can be present as powder or syrup and maltitol is added as maltitol syrup at 70% dry substance (= commercial base).

These viscous syrups are used for the preparation of sugar-free hard candies, which are transparent, non-hygroscopic, non-cariogenic and non-sticky.

The dry base of the viscous syrup comprises more than 14% maltitol syrup, preferably more than 17.5%, more preferably 21% of dry substance of maltitol syrup is

included in the viscous syrup. The viscous syrup comprises on dry substance more than 86% isomalt, preferably more than 82.5%, more preferably 79% isomalt is included in the viscous syrup.

The dry substance of the maltitol syrup comprises at least 20% higher polyols, preferably more than 22% higher polyols.

During a process for producing hard candies the feedstock for preparing hard candies is heated followed by a cooling phase until suitable viscosity is reached for pouring the hard candies in moulds. By applying more viscous mixtures the workability is improved, the processing time of the cooling phase is shortened and the final viscosity is reached sooner. In principle the processing time of the cooling phase is reduced with one quarter compared to the processing time required to cool the mass consisting of syrups based on hydrogenated isomaltulose alone. Consequently working with higher mass viscosity has a significant impact on the economics of the process for preparing hard candies.

Non-sticky, non-hygroscopic and non-cariogenic hard candies are obtained.

Brief description of the drawings

Figure 1 shows the mass viscosity profile from the hard candies prepared with 70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) consisting of 30% hydrogenated isomaltulose powder (C☆ Maltidex C16500) and 70% maltitol syrup added at commercial base (=70% dry substance), -Δ-), which is compared to the mass viscosity of hard candies prepared from hydrogenated isomaltulose (C☆ Maltidex C16500, _), respectively.

Figure 2 shows the hygroscopicity (at 70% relative humidity, and 25°C) of hard candies prepared from hydrogenated isomaltulose (C☆ Maltidex C16500, -□-), maltitol syrup (C☆ Maltidex M16311, -o-), and 70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) consisting of 30% hydrogenated isomaltulose powder (C☆ Maltidex C16500) and 70% maltitol syrup added at commercial base (=70% dry substance), -Δ-), respectively.

Figure 3 shows the telemetric evaluation of hard candies prepared 70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) consisting of 30% hydrogenated isomaltulose powder

(C☆ Maltidex C16500) and 70% maltitol syrup added at commercial base (=70% dry substance), followed by sucrose intake.

Detailed description of the invention

The present invention discloses the preparation of highly viscous syrups at dry substance between 60% to 80%, preferably of about 70% consisting of a mixture of maltitol syrup and isomalt. Isomalt can be present as powder or syrup and maltitol is added as maltitol syrup at 70% dry substance (= commercial base).

The dry base of the viscous syrup comprises more than 14% maltitol syrup, preferably more than 17.5%, more preferably 21% of dry substance of maltitol syrup is included in the viscous syrup. The viscous syrup comprises on dry substance more than 86% isomalt, preferably more than 82.5%, more preferably 79% isomalt is included in the viscous syrup.

The dry substance of the maltitol syrup comprises at least 20% higher polyols, preferably more than 22% higher polyols.

Maltitol syrups are derived from hydrogenated starch hydrolysates, which is another name for hydrogenated corn syrup. Since the latter comprises glucose, maltose, maltotriose, maltotetraose and higher glucose oligomers ((DPn where n = >4), and "DP" refers to the degree of polymerisation, i.e. the number of glucose units in the molecule), the hydrogenated product will contain sorbitol, maltitol, maltotriitol, maltotetraitol and hydrogenated oligomers (higher polyols). Suitable maltitol syrups at 70% dry substance contain a significant amount of higher polyols contributing to the increased mass viscosity.

A typical composition of dry substance of a suitable maltitol syrup is:

at least 50% maltitol,

less than 5% sorbitol,

10% to 26% maltotriitol + maltotetraitol,

at least 20% higher polyols (hydrogenated oligomers).

A more typical composition of dry substance of the maltitol syrup consists of 53% maltitol, 4% sorbitol, 19% (maltotriitol + maltotetraitol) and 24% higher polyols (hydrogenated oligomers), while the dry substance is 70% total of the syrup.

Isomalt is added as powder or syrup and can be either hydrogenated isomaltulose or hydrogenated isomerised saccharose. Hydrogenated isomaltulose is the quasi-equimolar mixture of 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), and 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM). Hydrogenated isomerised saccharose can be prepared according to a method as is described in EP 0 625 578, and the dry substance comprises a mixture of 10% to 50% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 35% to 60% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM) and 2% to 60% 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS). A typical composition of dry base of hydrogenated isomerised saccharose comprises 43.6% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 49.2% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM) and 3.1% 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS).

The viscous syrup at about 70% dry substance comprises 80% isomalt syrup (= hydrogenated isomerised saccharose at 70% dry substance), preferably 75% isomalt syrup, more preferably 70% isomalt syrup.

70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) refers to a mixture consisting of 30% hydrogenated isomaltulose powder (C☆ Maltidex C16500) and 70% maltitol syrup added at commercial base (=70% dry substance).

A typically composition of the dry base of the highly viscous syrups according to the present invention consists of:

7 % to 43% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS),

24.5% to 48% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM),

0% to 48% 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS),

at least 7% maltitol,

at least 4% higher polyols (hydrogenated oligomers),

less than 1.5% sorbitol,

1.4% to 7.8% (maltotriitol + maltotetraitol).

A more typical composition of the dry base of the syrup consists of:

39.5% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS),

39.5% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM),

11.1% maltitol,

5.1% higher polyols,

0.8% sorbitol,

4% (maltotriitol + maltotetraitol).

Production of the hard candies may be carried out in batch evaporators or in continuous cookers, and the process time at elevated temperature generally being up to 15 minutes, preferably in the range 5 to 10 minutes.

The process used to produce hard candies from maltitol containing syrups customarily operates at a temperature between 145°C and 170°C, preferably between 150°C and 160°C. At these temperatures it is preferable to apply a low vacuum, suitably 0.6 to 0.8 bar at the end of the heating period to facilitate water removal. The shaping of the hard candies is performed according to either one of the classically applied methods, being the 'stamping' method and the 'depositing' method, respectively. In the 'stamping' method the cooked mass is cooled to 90°C or 100°C, and colour, flavour and acid is mixed in. Then the mass is further cooled to 60°C or 70°C for shaping. After further cooling the candies are wrapped. In the 'depositing' method the cooked mass is cooled to 110°C or 120°C, colour, flavour and acid are mixed in. The hot mass is dosed in moulds, further cooled and demoulded afterwards. After further cooling the hard candies are wrapped.

In each method the heating phase is followed by a cooling phase and by applying more viscous mixtures (i.e. high mass viscosity) the workability is improved, the processing time of the cooling phase is shortened, and the final viscosity is reached sooner. In principle the processing time of the cooling phase is easily reduced with one quarter of the total time compared to the processing time required to cool the mass consisting of syrups based on hydrogenated isomaltulose alone. When working with a lab cooker on quantities of about 4 kg syrup, the cooling phase can easily be shortened with about 10 to 15 minutes compared to the cooling phase where hydrogenated isomaltulose syrups are applied solely. The processing time of the cooling phase of 4 kg syrup

consisting of hydrogenated isomaltulose is about 40 to 60 minutes, while with the syrups of the current invention the processing time is shortened with 10 to 15 minutes.

The mass viscosity is measured directly after cooking with an oscillating shear-disc viscometer. The measurement is started at 135°C and the sample is cooled with constant rate of 2.8°C/ minute to 94°C and the measured values are recorded by means of a potentiometric line recorder.

The mass viscosity of hard candies prepared from hydrogenated isomaltulose is around 20,000 mPa.s at 94°C and hard candies prepared from hydrogenated isomerised saccharose have a mass viscosity of about 15,000 mPa.s. In comparison the mass viscosity of a mixture with 70/30 isomalt/maltitol (C☆ Maltidex C16510) is about 30,000 mPa.s at 94°C. This increased mass viscosity results in improved workability and the cooling time is reduced with 10 to 15 minutes when working in a lab cooker of 4 kg scale. Applying in the corresponding 70/30 isomalt/maltitol mixtures (prepared from 30% hydrogenated isomaltulose (powder) and 70% maltitol syrup at 70% dry substance) maltitol syrups, wherein the higher polyol content of dry base is below 20%, results in hard candies having a mass viscosity below 25,000 mPa.s, namely about 23,600 mPa.s.

Hard candies with a mass viscosity higher than 25,000 mPa.s, preferably higher than 27,000 give good workability and significant reduction of the processing time of the cooling phase. The time to reach the appropriate viscosity before moulding, is shortened with one quarter of the total cooling time of syrups based on hydrogenated isomaltulose alone.

The feedstock for preparing hard candies of the present invention may comprise 10 to 35 % by weight of water based on the weight of the mixture, most often about 30% by weight water. This feedstock is heated to an elevated temperature until a product is obtained which preferably contains less than 5% by weight water, more preferably less than 4%, more preferably less than 2% by weight or less, based upon the weight of the candy.

Furthermore the polyol-containing feedstock of the present invention also includes flavour and/or colouring matter or any other additive commonly found in hard candy products.

The candy stickiness test is performed with the Texture Analyser TA-XT2 from Stable Micro Systems. The stickiness measurement can be done by storing the candy several minutes to hours at specific conditions of humidity and temperature and the more sticky the candy the higher the adhesive force becomes. The confectionery hygroscopicity is measured in a microclimate chamber with an accurate regulation system having the possibility to create conditions of temperature from 10°C to 98°C and relative humidity from 10 to 95%. The moisture pick-up of the samples placed in the microclimate chamber stored under specific conditions of temperature and humidity is calculated from the difference in weight of the samples after a specific storage time.

Hard candies prepared with hydrogenated isomaltulose give a stickiness of 175 g (after 10 minutes cooling) at 21°C and 52% relative humidity (RH), while hard candies prepared with the 70/30 mixture isomalt/maltitol mixtures (C☆ Maltidex C16510) have under similar conditions a candy surface stickiness of 171 g. Applying maltitol syrups, wherein the higher polyol content is below 20%, in 70/30 isomalt/maltitol mixtures (prepared from 30% hydrogenated isomaltulose (powder) and 70% maltitol syrup at 70% dry substance) gives hard candies with surface stickiness (21°C at 52% RH after 10 minutes cooling) of 215 g. Stickiness of hard candies prepared from hydrogenated isomerised saccharose is determined as being 173 g at 21°C (10 minutes cooling) and 49% RH. Under the same conditions hard candies prepared from the 70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) have a candy surface stickiness of 167g. Surprisingly the surface stickiness of hard candies prepared from the 70/30 isomalt/maltitol mixture (C☆ Maltidex C16510) is at least as low as the candy surface stickiness of hard candies prepared from hydrogenated isomaltulose and is even better than surface stickiness of hard candies prepared from hydrogenated isomerised saccharose. Reducing the content of higher polyols in the maltitol syrups results in more sticky hard candies.

Relative humidity below 50% and 22-23°C are ideal conditions to store demoulded hard candies prepared from 70/30 isomalt/maltitol (C☆ Maltidex C16510). Under these conditions the candy surface stickiness should not exceed 200 g, preferably is not higher than 180 g.

The corresponding hygroscopicity (moisture pick-up) is slightly increased from 0.48% to 1.2% (after 14 days at 70% RH and 25°C) for hard candies prepared from hydrogenated isomaltulose and hard candies prepared from 70/30 isomalt/maltitol (C☆Maltidex C16510), respectively. This increase is insignificant if one considers that moisture pick-up of candies prepared from maltitol syrups goes up to 11%. The hygroscopicity of hard candies prepared from 70/30 isomalt/maltitol mixtures (prepared from 30% hydrogenated isomaltulose (powder) and 70% maltitol syrup at 70% dry substance, and wherein the dry base of the maltitol syrup contains less than 20% higher polyols) is about 1.15%. In general a moisture pick-up less than 5% after 14 days is regarded as acceptable.

Due to the low hygroscopicity of the hard candies prepared from 70/30 isomalt/maltitol mixtures (C☆ Maltidex C16510) the shelf life is correspondingly increased.

The telemetry technique is used to determine cariogenicity and continuously records plaque pH changes *in vivo* at the enamel-plaque interface and the plaque accumulates on the inserted glass electrode. If the plaque pH stays on the "alkaline side" of 5.7 within 30 minutes after consumption, the food can be labelled 'safe for teeth', or non-cariogenic. Hard candies prepared from 70/30 isomalt/maltitol mixtures (C☆ Maltidex C16510) have pH 6 in the telemetric method and are thus non-cariogenic.

The present invention results in non-hygroscopic, non-sticky, non-cariogenic hard candies with mass viscosity higher than 25,000 mPa.s, a candy surface stickiness below 180 g (50% RH, 22-23°C) and moisture pick-up (hygroscopicity) below 1.5%. Moreover as is well known the presence of maltitol improves the flavour release.

The present invention is illustrated by way of the following examples.

Example 1.

Cooking

4 kg 70/30 isomalt/maltitol syrup (C☆Maltidex C16510, d.s. = 70% and dry substance consists of 39.5% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 39.5% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM), 11.1% maltitol, 5.1% higher polyols, 0.8%

sorbitol, 4% (maltotriitol + maltotetraitol)) were placed in the lab cooker without water addition. It was cooked under vacuum at 155°C during 5 minutes to reach an end-moisture of max. 1.6%.

Shaping

"Depositing" method

The cooked mass was cooled to 110-120°C and colour, flavour and acid were mixed in. The hot mass was dosed in Teflon coated aluminium moulds and allowed cooling further, followed by demoulding. After further cooling the hard candies were wrapped.

Example 2.

Cooking

4 kg hydrogenated isomaltulose powder (C☆ Maltidex C16500) was first mixed with 1.3 kg water and pre-heated to 90-100°C. Then the mixture was cooked up in the lab cooker under vacuum at 155°C during 5 minutes to reach an end-moisture of 1.6%.

Shaping of the hard candies is similar as in example 1.

Example 3.

Cooking

4 kg maltitol syrup at 70% dry substance (C☆ Maltidex L16303, M16311 or H16323) was placed in the lab cooker without water addition. It was cooked under vacuum at 168°C during 5 minutes to reach an end-moisture of max. 1%.

Shaping of the hard candies is similar as in example 1.

Example 4.

Cooking

4 kg isomalt/maltitol syrup (d.s. = 70% and dry substance consists of 39.5% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 39.5% 1-O-α-D-glucopyranosyl-D-mannitol (1,1

GPM), 11.55% maltitol, 3.59% higher polyols, 0.95% sorbitol, 4.91% (maltotriitol + maltotetraitol)) were placed in the lab cooker without water addition. It was cooked under vacuum at 155°C during 5 minutes to reach an end-moisture of max. 1.6%.

Shaping of the hard candies is similar as in example 1.

Example 5.

Cooking

4 kg hydrogenated isomerised saccharose syrup (d.s. = 70% and dry substance comprises 43.6% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS), 49.2% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM) and 3.1% 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS)) was placed in the lab cooker without water addition. It was cooked under vacuum at 155°C during 5 minutes to reach an end-moisture of max. 1.6%.

Shaping of the hard candies is similar as in example 1.

Example 6 – Application parameters of products prepared according to the previous examples.

Viscosity of Hard Candies

The oscillating shear-disc viscosimeter consists of two discs, which are vertically installed and face each other in parallel.

The shear-disc, which is arranged above the oscillating sample disc, is connected with a torque-measuring device. The lower disc is connected with the drive and it oscillates at an adjustable frequency and with a constant oscillating angle. A digital temperature control is done for both discs by means of a circulation thermostat with heating capacity up to 210°C and cooling coil with a capacity up to 20°C.

A small sample of the mass was brought directly after cooking on the shear disc, both discs were tilted together, and oscillating was started. The measurement was started at 135°C and cooled with constant rate of 2.8°C/ minute to 94°C, and the measured values were recorded by means of a potentiometric line recorder.

The results are displayed in table 1.

Table 1

Hard candies prepared according to:	Mass viscosity at 94°C (mPa.s):
Example 1 - C☆Maltidex C16510	30,000
Example 4	23,600
Example 2 - C☆ Maltidex C16500	20,000
Example 5 - Hydrogenated isomerised saccharose	15,000
Example 3 - C☆ Maltidex M16311	533,029

Some of the measured viscosities are shown in Figure 1.

Confectionery Hygroscopicity

Microclimate Chamber

The microclimate chamber is made from a stainless steel interior, with conditioned air and diffused moisture injection microprocessor controlled. The door opening gives access to the total working space in which the samples are placed. The microprocessor achieves precise environmental control and the distinct advantage of rapid recovery after each door opening. By means of a fan and air guide walls, a forced but moderated air circulation ensures an even airflow over the samples.

The moisture pick-up of the samples placed in the microclimate chamber stored at 70% relative humidity and at 25°C was calculated from the difference in weight of the samples after 14 days.

The confectionery hygroscopicity is displayed in Table 2.

Table 2

Hard candies prepared according to:	Hygroscopicity (70% R.H, 25°C, after 14 days)
Example 1 - C☆Maltidex C16510	1.2%
Example 4	1.15%
Example 2 - C☆ Maltidex C16500	0.48%
Example 5 - Hydrogenated isomerised saccharose	0.96% (after 11 days)
Example 3	11%

The confectionery hygroscopicity of some hard candies is displayed in Figure 2.

Candy Stickiness test

The candy stickiness test is performed with the Texture Analyser TA-XT2 from Stable Micro Systems.

A moulded candy having a diameter of 40 mm and 5 mm thickness was fitted at the lower jaw of the texture analyser base. A transparent foil loop of specific dimensions (100 mm length and 12 mm width) was fitted into the upper jaw and brought on the candy surface with a force of 40 g. The loop was then pulled away from the candy surface at high speed (10 mm/sec) and the adhesive force was measured. The stickiness measurements were done at 52% relative humidity at 21°C or at 49% relative humidity and 21°C. The corresponding results are displayed in Table 3.

Table 3

Hard candies prepared from:	**Stickiness**
Example 1 - C☆Maltidex C16510	171 g (at 52% RH, 21°C)
Example 2 - C☆ Maltidex C16500	175 g (at 52% RH, 21°C)
Example 4	215 g (at 52% RH, 21°C)
Example 2 - C☆ Maltidex C16500	167 g (at 49% RH, 21°C)
Example 5 - Hydrogenated isomerised saccharose	173 g (at 49% RH, 21°C)

The more sticky the candy the higher the adhesive force (here expressed in g).

Telemetric method

The cariogenicity of hard candies prepared from 70/30 isomalt/maltitol mixture (C☆Maltidex C16510) is determined with the telemetric method.

The telemetry technique continuously records plaque pH changes *in vivo* at the enamel-plaque interface and the plaque accumulates on the inserted glass electrode. If the plaque pH stays on the "alkaline side" of 5.7 within 30 minutes after consumption, the food can be labelled 'safe for teeth', or non-cariogenic.

The results are displayed in figure 3.

After consumption of hard candies prepared from 70/30 isomalt/maltitol mixtures (C☆Maltidex C16510) pH stays above 6 and the hard candies are thus non-cariogenic.

Claims

1. A syrup at dry substance between 60% to 80%, preferably at dry substance of about 70% consisting of a mixture of maltitol syrup and isomalt powder or isomalt syrup.

2. A syrup according to claim 1 characterised in that the dry substance of the maltitol syrup comprises more than 20% higher polyols, preferably more than 22% higher polyols.

3. A syrup according to claim 1 and 2 characterised in that the dry base of the syrup consists of:

   7 % to 43% 6-O-α-D-glucopyranosyl-D-sorbitol (1,6 GPS),
   24.5% to 48% 1-O-α-D-glucopyranosyl-D-mannitol (1,1 GPM),
   0% to 48% 1-O-α-D-glucopyranosyl-D-sorbitol (1,1 GPS),
   at least 7% maltitol,
   at least 4% higher polyols (hydrogenated oligomers),
   less than 1.5% sorbitol, and
   1.4% to 7.8% (maltotriitol + maltotetraitol).

4. A sugar-free hard candy comprising a syrup according to anyone of claims 1 to 3.

5. A sugar-free hard candy according to claim 4 characterised in that the mass viscosity is higher than 25,000 mPa.s, and that the candy surface stickiness is below 180 g (50% RH, 22-23°C) and the moisture pick-up (hygroscopicity) after 14 days is below 1.5%.

6. A process for the production of a sugar-free hard candy comprising the following steps:

   a) preparing a mixture of maltitol syrup and isomalt powder or isomalt syrup.
   b) cooking at a temperature between 145°C and 170°C and low vacuum, and
   c) shaping according to stamping or deposit method.

7. A process according to claim 6 characterised in that flavour and/or colouring matter is added during shaping.

8. A process according to claim 6 and 7 characterised in that the syrup comprises 10 to 35% by weight water.

9. A process according to claim 6 to 8 characterised in that the water content of the hard candy is less than 4% by weight, preferably less than 2% by weight or less, based upon the weight of the hard candy.

Abstract

The present invention discloses a mixture consisting of maltitol syrup and isomalt powder or isomalt syrup, and the sugar-free hard candies prepared from them. The dry base of the maltitol syrup comprises more than 20% higher polyols, preferably more than 22% higher polyols. Non-sticky, non-hygroscopic and non-cariogenic hard candies are obtained.

Figure 1: Candy Mass Viscosity

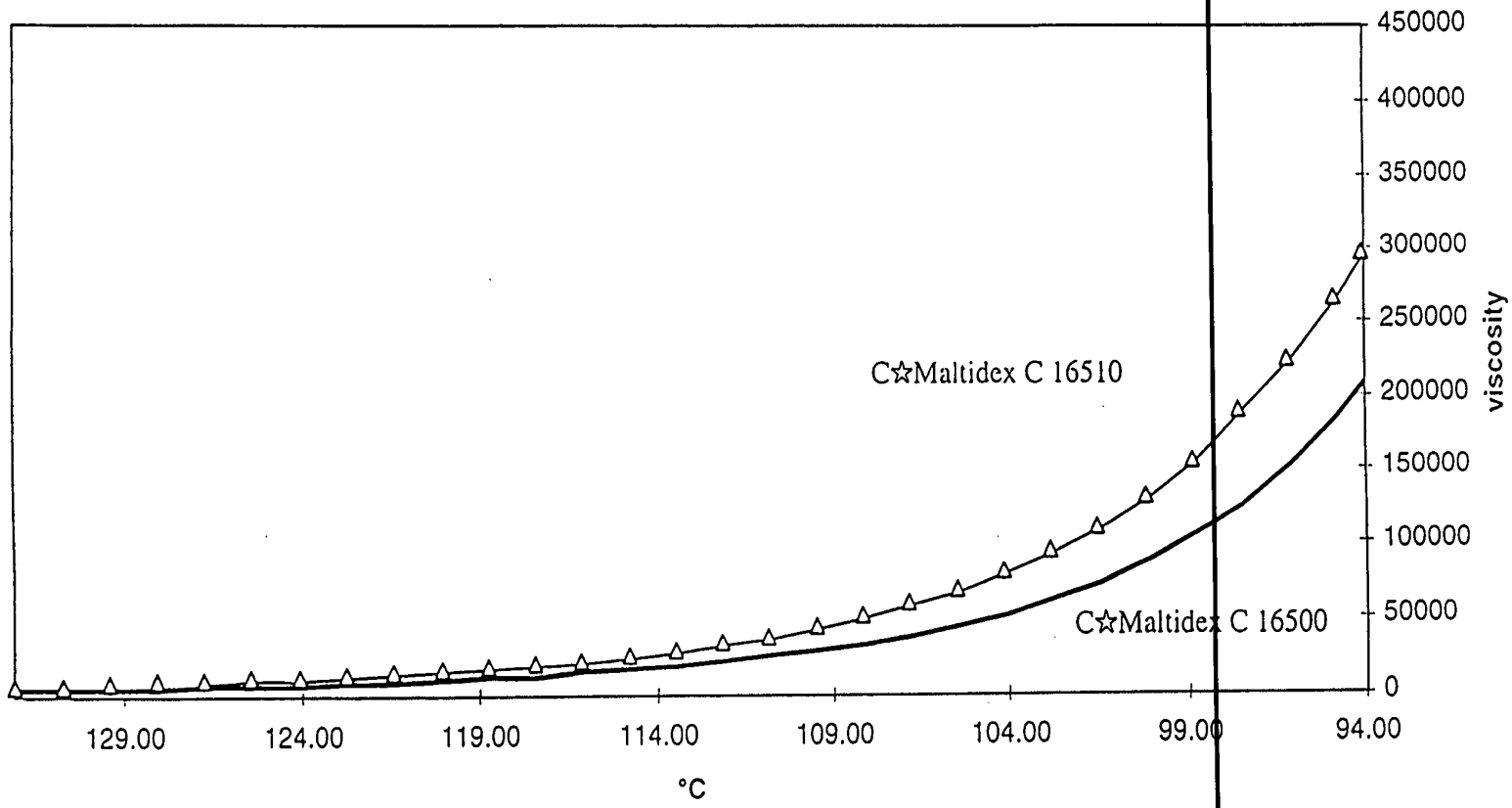

Figure 2:Hard Can[illegible]s – Hygroscopicity at 70% RH, and 25°C

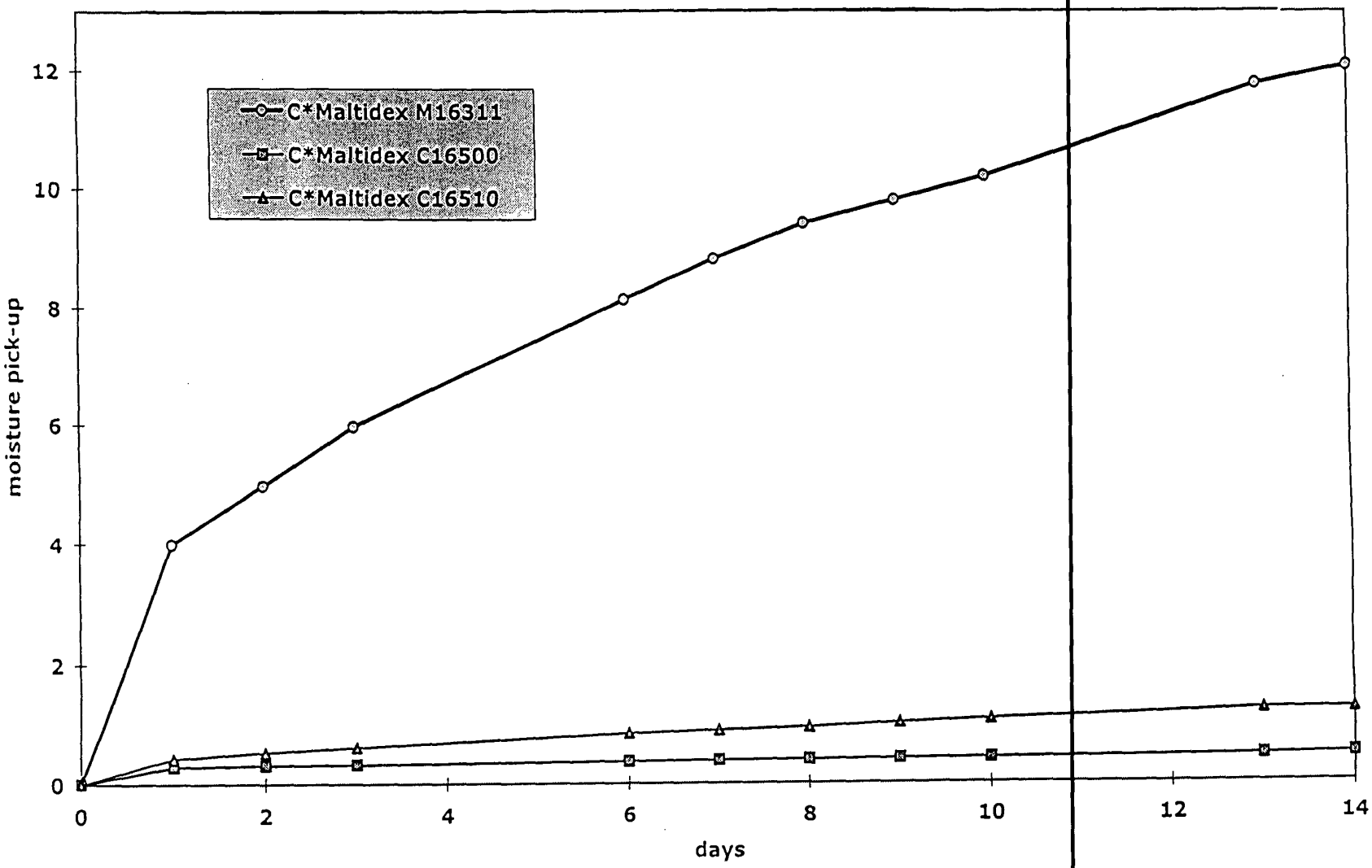

Figure 3: Telemetric Evaluation Hard Candy